

Experience With Gaseous Spring Water as a Contrast Agent in Tubal Patency Assessment

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Background: Tubal occlusion is one of the most common causes of female infertility. For many years the fallopian tube assessment was done by laparoscopy or hystero-graphy, until the advent of color Doppler and various contrast agents. The purpose of this study was to introduce a new contrast agent i.e. gaseous spring water for the evaluation of tubal patency as an alternate to existing available contrast agents based on galactose matrix air bubbles, which are expensive and not easily available in third world countries.

Materials and Methods: The technique used is same as used in other procedures i.e. insertion of a hysterosalpingosonography (HSS) catheter into the uterine cavity, instilling fluid/contrast agent and with the help of endovaginal probe visualizing the movement of echoes into the tubes and the observation of fluid in the pouch of Douglas.

Results: We examined 721 patients from January 2006 to December 2007. We used about 7 mL of gaseous spring water per patient on an average. We found that 578 (80.1%) patients had patent tubes, 70 (9.7%) patients had unilateral blocked tubes and 59 (8.1%) patients had bilateral blocked tubes. Two (0.27%) patients were found to have one tube blocked, but when rescanned in the next cycle due to spasm, it was found to be patent. Two (0.27%) patients had only one tube because of a salpingectomy done previously due to ectopic pregnancies and in 10 (1.3%) patients with bilateral patent tubes, one of the tubes showed a slightly reduced amount of spill as compared to the fellow tube, making the diagnosis of partial blockage. The mean time spent on the procedure was 7 minutes.

Conclusion: It is recommended that gaseous spring water be used as a first line of choice for assessing tubal patency as it is cost effective, safe and easily available, and does not require radiology suite.

KEY WORDS — endovaginal probe, gaseous spring water, hysterosalpingosonography (HSS), tubal patency

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Introduction

Tubal occlusion is one of the most common causes of female infertility accounting for approximately 25–35% of cases [1]. Although laparoscopic chromopertubation remains the gold standard in diagnosis of tubal disease, hysterosalpingography is still widely used with other newer modalities emerging which offer more advantages [2]. Several new techniques have been proposed including sonohysterography with saline water and saline with air [3–6].

For the sake of a low cost contrast medium many investigators have independently attempted to use air as a contrast medium to assess tubal patency [3]. Jeanty et al, in their search for an ideal contrast agent, used air contrast sonohysterography and found it to be in agreement with laproscopic chromopertubation in 79.4% of cases with a sensitivity of 85% and a specificity of 87%, along with being inexpensive, quick and better tolerated by the patient as compared to hysterosalpingography [3]. Later air contrast sonohysterography was reported to be even superior to hystersalpingography and comparable to laparoscopic chromopertubation in diagnosing tubal infertility [2].

At our centre in early 1990s we used power Doppler endovaginal ultrasound to assess tubal patency by seeing flash artifacts at the fimbrial end after instilling saline. With the introduction of Echovist (Schering AG, Berlin, Germany) and its availability in Pakistan, we carried out several hundred tests. Since the contrast agent was expensive and not easily available at all times, we were in search of another contrast agent, which could be cost effective, easily available, and safe. We used with utmost care the gaseous spring water and were amazed to see fantastic results.

Materials and Methods

To undertake this experimental study approval was taken from the Ethics Review Board of the Ultrasound Society of Pakistan (USP). No funding was provided by any organization and no financial

interests are related to the material in the manuscript.

This study was conducted at the Clinic/Institute of Ultrasound Imaging, which is affiliated with Thomas Jefferson University Hospital, Philadelphia, USA. Our Institute is a referral centre where patients are referred from leading private and government hospitals of the city. Our centre caters to almost 25,000 patients in a year. Machines used at our centre during the procedure, are all high tech including Toshiba Nemio-20, 17 & Toshiba Xario.

During the period from January 2006 to December 2007, about 721 women with complaints of primary or secondary infertility were assessed for tubal patency. We used gaseous spring water as the new contrast agent. The safety of gaseous spring water was checked by randomly sending four samples of water including gaseous spring water labeled as A, B, C, and D to the laboratory. The result showed no bacteria in spring water and was found fit for human consumption. This bottled spring water was also treated at source with ultraviolet and infra red rays before use.

Patients included in our research were all referred patients from different hospitals, with complains of either primary (53%, $n=382$) or secondary (47%, $n=338$) infertility, for the assessment of tubal patency. The age group ranged from 18 years to 36 years. The test was done between days 6–10 of the menstrual cycle or 2 days after the menses were over. Written consent was taken from first five patients and oral informed consent was taken from the rest of the patients who were also pre informed by the referring physicians.

The principal investigator along with one of the co-investigators performed the test. The cervix was visualized with a speculum. Following cleansing of the cervix with an antiseptic, a soft flexible 5 or 7 Fr HSS balloon catheter was inserted into the uterine cavity. The speculum was then removed and the endovaginal probe inserted. 5–10 mL of an echo-enhancing agent i.e. gaseous spring water was inserted very slowly so that micro air bubbles were not destroyed. Tubal patency was assessed by the movement of micro air bubbles, which were echo



Figs. 1 & 2 Endovaginal scan showing a transverse section of the uterus with a comet tail artefact of micro air bubbles of spring water in the uterine cavity.

enhanced and had a comet tail artifact (Figs. 1 and 2). The criteria for tubal patency was either the movement of micro air bubbles associated with comet tail artifacts in the tube up to the fimbrial end (Figs. 3 and 4) or by observing 10 seconds of uninterrupted flow at the interstitial end.

After the insertion of the catheter, the time taken to perform Tubal patency was between 3 to 14 minutes. Most of the procedures took under 10 minutes. Gaseous spring water in volumes of 5–15 mL was used and a majority of patients required 7 mL of gaseous spring water. In some patients, B-flow was also used to check the passage of micro air bubbles (Figs. 5 and 6). This shortened the examination time and increased the frequency of reliable signals.

All patients were advised to have antibiotics (Tab. Vibramycin 100 mg 1+0+1) for 5 days as a prophylactic measure after the procedure. Patients were advised to have Tab. Paracetamol 500 mg stat if they had any pain soon after the procedure.

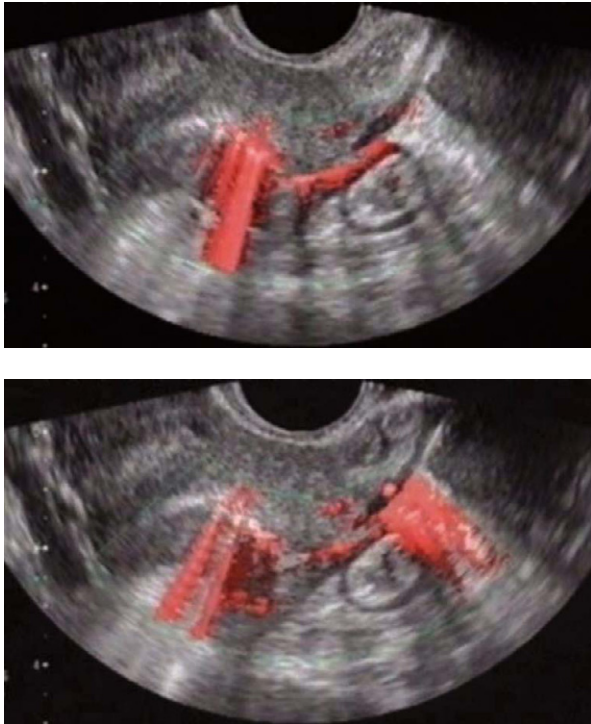


Figs. 3 & 4 Endovaginal scan showing a transverse section of the uterus with a comet tail artefact of micro air bubbles outlining the fallopian tube.

Results

Out of 721 patients examined for tubal patency by using gaseous spring water 578 patients (80.1%) were found to have bilateral patent tubes, 70 patients (9.7%) had unilateral blocked tubes, and 59 patients (8.1%) had bilateral blocked tubes. Two patients (0.27%) were found to have one tube blocked, but when rescanned in the next cycle due to of spasm, it was found to be patent. Two patients (0.27%) had only one tube because of a salpingectomy done previously due to ectopic pregnancies, and in ten (1.3%) patients with bilateral patent tubes, one of the tubes showed a slightly reduced amount of spill as compared to the fellow tube making the diagnosis of partial blockage.

Besides the patency of tubes, the procedure disclosed other findings as well. One of the patients who came for a tubal patency test was previously diagnosed as a case of endometriotic cyst/tubo



Figs. 5 & 6 Endovaginal scan of the uterus showing passage of micro air bubbles of spring water in the tubes by B-flow.

ovarian (TO) mass, and was found to have pyosalpinx when micro air bubbles were seen entering the complex mass. Fifteen patients had fibroids out of which three patients had submucosal fibroids which showed unilateral tubal blockage. The remaining twelve had bilaterally patent tubes. Four patients had polyps and two patients showed synechiae.

All the patients undergoing the procedure were asked to report back in case of any complications but none reported back so we assumed that none of the patients experienced any late complications. The immediate complications were rare (4.1%, $n=30$). They included mild pelvic discomfort while inflating the bulb of the uterine catheter (2.9%, $n=20$), mild lower abdominal pain while instilling the spring water into the uterine cavity (0.83%, $n=6$) and mild backache while the contrast agent was seen passing through the fallopian tubes (0.55%, $n=4$).

Ten patients (1.3%) in this study who were found to have either one or both blocked tubes and could also afford laparoscopy, were further

evaluated and results were found to be in conformity with our results. However due to the limited number of these patients we cannot give the sensitivity and specificity of the contrast agent. Since the referral for a tubal patency test was from different hospitals and different cities the follow up on patients who got pregnant was very limited. In all 24 (3.3%) patients who came to our clinic for antenatal ultrasound told us that they had conceived in the three months following the tubal patency test done in our center.

RESULTS OF SPRING WATER SONOHYSTEROGRAPHY BY PATIENTS ($n=721$)

Bilateral patent tubes	80.1% ($n=578$)
Unilateral blocked tubes	9.7% ($n=70$)
Bilaterally blocked tubes	8.1% ($n=59$)
Unilateral patent tube + one sided salpingectomy	0.27% ($n=2$)
Unilateral patent tube + one probably patent	0.27% ($n=2$)
Unilateral patent tube + one partially blocked tube	1.3% ($n=10$)

COMPLAINS AFTER SPRING WATER SONOHYSTEROGRAPHY BY PATIENTS ($n=721$)

Immediate complaints	4.1% ($n=30$)
Mild pelvic discomfort	2.7% ($n=20$)
Mild lower abdominal pain	0.83% ($n=6$)
Mild backache	0.55% ($n=4$)
Late complications	0% (none)

Discussion

For many years the fallopian tube assessment was not possible with ultrasound until the advent of color and power Doppler. We studied six patients in 1987 by instilling saline in the uterine cavity and then looking for fluid in the cul-de-sac. This provided information that at least one tube was patent. Clinical comparison of sonographic hydrotubation and hysterosalpingosonography as a comparative study came to the forefront in 1991. It helped in the evaluation of the uterine shape, its cavity, the

flow of saline through the tubes, the presence of hydrosalpinges and the presence of fluid in the pouch of Douglas [5]. Allahbadia (1992) reported his study on tubal patency and called it SION test [6]. Later in 1993, Allahbadia evaluated tubal patency using color Doppler ultrasonography in infertile women [7]. By using contrast medium, sonohysterosalpingography is an alternate method for assessing tubal patency [8–11]. Moreover, sonohysterographic method helps us in the detection of tubal and uterine abnormalities. Furthermore, it was proved by various studies that air contrast HSS is quick, inexpensive and better tolerated by patients than HSG [12,13]. Our data indicates that performing hysterosalpingosonography with gaseous spring water is an accurate means for the initial assessment of tubal patency. The tubal patency test demonstrates an evolution from non specific observation of accumulation of cul-de-sac fluid to positive tubal identification.

Previously few studies had used color and power Doppler with gray scale sonography to improve the visualisation of the tubes but found out that power Doppler sonography caused so many artifacts that the identification of tubes was more difficult and color Doppler was less sensitive and also demonstrated too many flash artifacts [7]. In our study we used B-flow to confirm the passage of micro air bubbles in a few patients, which shortened the examination time and showed satisfactory results.

If the fallopian tube is not visualised it may be due to a spasm, peritubal adhesion, obstruction or a difference in the permeability between the two tubes [3]. Spring water has air incorporated under high pressure so even this difference of permeability does not cause a bias in results, although in ten (1.3%) patients with bilateral patent tubes one of the tubes showed a slightly reduced amount of spill as compared to the fellow tube, making the diagnosis of partial blockage. Air contrast sonography was found to cause a lesser degree of discomfort [3]; in our study using spring water the rate of complication was even lower than in other studies. None of our patients experienced any shoulder

pain, vasovagal reaction or infection. The gaseous spring water should be pushed with very little pressure, to avoid disintegration of micro air bubbles. If there is intravasation the procedure should be stopped immediately. In cases of a bilateral tubal blockage, slight distension of the uterine cavity was noted because the spring water was unable to move into the fallopian tubes or move out of cervix because of the bulb. This distension of the cavity was also taken as a confirmatory sign of a bilateral tubal blockage. The procedure should be performed by an experienced sonologist who has performed at least 30 cases under supervision. The advantages of this procedure are:

- a) No exposure to fluoroscopic radiation.
- b) No exposure to allergens
- c) Radiology suite not required
- d) Can be repeated in the next cycle if tubal spasms occur
- e) Cost effective
- f) Less time consuming than HSG.
- g) No premedication required unless the patient has a low pain threshold or is having preprocedural stress and anxiety.

Thus, tubal patency assessment with gaseous spring water was found to be cost effective, safe, easily available and less time consuming than HSG. It is recommended that spring water should be used to check tubal patency in subfertile women.

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